



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/849,348	05/19/2004	Robert H. Burgener II	3398.2.10	6690

21552 7590 09/08/2005

MADSON & METCALF
GATEWAY TOWER WEST
SUITE 900
15 WEST SOUTH TEMPLE
SALT LAKE CITY, UT 84101

EXAMINER

LOUIE, WAI SING

ART UNIT	PAPER NUMBER
----------	--------------

2814

DATE MAILED: 09/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Office Action Summary	Application No.	Applicant(s)	
	10/849,348	BURGENER ET AL.	
	Examiner	Art Unit	
	Wai-Sing Louie	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-41 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-41 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>8/04, 6/05</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-9, 11-12, 14-16, 18-20, 22-28, 31-35, and 37-39 are rejected under 35 U.S.C. 102(e) as being anticipated by White et al. (US 6,291,085).

With regard to claims 1 and 23, White et al. disclose a ZnO light-emitting device (col. 3, line 63 to col. 9, line 7) comprising a pn junction containing a p-type Group II-VI semiconductor material and an n-type Group II-VI semiconductor material (col. 2, lines 20-30), where the p-type Group II-VI semiconductor comprises a single crystal thin film of a ZnO doped with p-type dopant (col. 2, line 32), where the p-type dopant concentration in p-type ZnO layer is greater than 10^{16} atoms.cm⁻³, where the semiconductor resistivity is less than 0.5 ohm.cm, and where the carrier mobility is greater 0.1 cm²/V.s (col. 2, lines 31-36).

With regard to claim 2, White et al. disclose the Group II element is Zn (col. 2, line 21).

With regard to claim 3, White et al. disclose the Group IV element is oxygen (col. 2, line 21).

With regard to claims 4 and 24, White et al. disclose the p-type dopant is phosphorus (col. 4, line 18-20 and fig. 2).

With regard to claim 11, the method of deposition is a process limitation, which does not carry any patentable weight in a device prosecution.

With regard to claim 12, White et al. disclose the Group II-VI semiconductor material is ZnO (col. 2, line 21).

With regard to claims 5-9 and 25-28, White et al. disclose the other p-type dopants include arsenic, antimony, bismuth, copper (col. 4, lines 13-20).

With regard to claims 14-16 and 33-35, White et al. disclose the device could be a light-emitting diode, or a laser diode, or a field effect transistor (col. 1, lines 11-14).

With regard to claims 18-20 and 37-39, White et al. disclose the device emits light at a wavelength of about 370 nm (fig. 2).

With regard to claim 22, White et al. disclose the n-type semiconductor material is an n-type ZnO (col. 3, lines 10-25).

With regard to claims 31-32, White et al. disclose n-type semiconductor material is ZnO and the n-type dopant is aluminum (col. 7, lines 19-29).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 10, 21, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over White et al. (US 6,291,085) in view of Haga (US 6,838,308).

With regard to claims 10, 21, and 40, White et al. do not disclose the self-supporting substrate surface is amorphous. However, Haga discloses the ZnO layer is disposed on an amorphous substrate 110 (Haga col. 4, lines 52-54 and fig. 3). Haga teaches the ZnO having a wurtzite type a-axis orientation and it is important to form on an amorphous substrate (Haga col. 4, lines 45-51). Therefore, it would have been obvious to one of ordinary skill in the art to modify White's device with the teaching of Haga to provide a substrate with an amorphous surface in order to form an a-axis crystal structure.

Claims 13 and 29-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over White et al. (US 6,291,085) in view of Yoshii et al. (US 6,707,074).

With regard to claim 13, White et al. do not disclose the Group II-VI semiconductor material is ZnS. However, sulfur is a Group IV element, which combines with zinc to form zinc sulfide, such as disclosed in Yoshii et al. disclose (Yoshii col. 20, lines 31-33). Yoshii et al. teach that it is possible to use a mixed crystal material of semiconductor compound to improve the light-emitting characteristic of the device (Yoshii col. 20, lines 31-50). Therefore, it would have been obvious to one of ordinary skill in the art to modify White's device with the teaching of Yoshii et al. to use ZnS as semiconductor material so that the light-emitting characteristic could be improve.

With regard to claims 29-30, White et al. modified by Yoshii et al. disclose the single crystal ZnO further comprises MgO and CdO (Yoshii col. 20, line 33).

Claims 17 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over White et al. (US 6,291,085) in view of Merrin (US 3,864,725).

With regard to claims 17 and 36, White et al. disclose a device having a pn junction, but do not disclose the device is a photodiode. However, it is common in the art to form a pn junction type photodiode such as disclosed in Merrin (Merrin col. 5, line 57 to col. 6, line 3). Therefore, it would have been obvious to one of ordinary skill in the art to form a pn junction photodiode.

Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over White et al. (US 6,291,085) in view of Harder et al. (US 5,331,655).

With regard to claim 41, White et al. do not disclose a barrier layer disposed between the single crystal ZnO and the amorphous self-supporting substrate. However, Harder et al. disclose the active layer can be a single or multiple quantum well, which includes a barrier layer (Harder - see the abstract). Harder et al. teach the barrier layer reduces carrier leakage out of the active region (Harder - see the abstract). Hence, it would have been obvious at the time the invention was made to modify White's device with the teaching of Harder et al. to provide a quantum well structure with a barrier layer in order to reduce carrier leakage out of the active region.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wai-Sing Louie whose telephone number is (571) 272-1709. The examiner can normally be reached on 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Wsl

September 5, 2005.

